has been great improvement, but it must be confessed that there is still need of increased carefulness. Thus, if we take (quite at random) p. 792, we have a paper by Bütschli stated to extend from p. 291 to p. 593 of the *Arch. Entwickmech.*, which is incredible ; Haacke's text-book called a Grunddiss ; Hertwig's " Streitfragen " wrongly spelt ; Hickson's paper on the medusæ of Millepora cited where it seems irrelevant—trivial mistakes all of them, but too many for one page, and it is so elsewhere. All the same, this third volume of " L'Année Biologique " is a fine piece of work, and every biologist will wish it the success it deserves. J. A. T.

AN ARITHMETICAL MISCELLANY.

Exercices d'Arithmétique. Par J. Fitz-Patrick et G. Chevrel. Deuxième édition. Pp. xiv + 680. (Paris : A. Hermann, 1900.)

THIS second edition of a very entertaining book differs from the first by the inclusion of more than 500 new and unsolved examples, and a supplement on commercial arithmetic, which, no doubt, will be found very useful by the French schoolmaster, but is so incongruous with the rest of the work as to recall Horace's well-known parable of the mermaid and its analogues in literature and art.

Apart from this concession to the practical, the authors, largely imbued with the spirit of Edouard Lucas, have provided their readers with a varied store of illustrations of Diophantine arithmetic and of numerous fundamental propositions in the theory of numbers. Their solutions are very clear and simple (though they might, with advantage, have made more use of the notation of congruences), and they will undoubtedly succeed in promoting a more general and intelligent interest in the theory of arithmetic.

Many of the examples are of a very elementary character ; but there are some which deserve the attention of expert mathematicians. For instance (p. 366), we have Lucas's determination of *all* the prime factors of $(a^{126} - b^{126}) (a - b)$, where a, b are the roots of $x^2 = x - 2$; the last five of these primes being

125541359, 25215201901, 34449677641, 153790567559, 733268745721.

This result is said to have been verified by M. Le Lasseur. Again (p. 158), the Rev. Father J. Pervouchine, of Perm, has found that $2^{2^{23}} + 1$, comprising 2525223 digits, is divisible by 167772161 ($= 5.2^{25} + 1$), which is prime. Here are mysteries which we must leave to Lieut.-Colonel Cunningham and Mr. Bickmore to unravel.

An agreeable element of humour is supplied by Question 399, on the interpretation of Art. 757 of the Civil Code ; that ambiguous drafting is not wholly unknown on the other side of the Channel is a surprise which is not without its consolations.

It would be tedious to detail even the more conspicuous features of this handsome volume ; enough to say that every student of arithmetic will find in it something to arouse his interest and extend his knowledge. If he is a novice, the study of this book will help him to appreciate the works of at least the earlier masters, such

as Euler and Lagrange ; if he is a veteran, he will find recreation in turning over its pages in his leisure moments.

There is one reflection which a perusal of the work can hardly fail to suggest. The province of arithmetic is so definite that one would expect its methods to be marked by a general uniformity. But this is far from being the case ; and there is, in particular, an unmistakable contrast between Diophantine arithmetic and the severe, but noble science founded by Lagrange, Gauss and Kummer, which we may distinguish as the analytical theory of numbers. Their points of contact in such things as the elementary theory of congruences and of residues only serve, at present, to accentuate their divergences ; it may almost be affirmed that they appeal to different classes of mind. To use a metaphor, we may say that one is the primitive gold-mining of the individual prospector, the other the systematic working of a quartz reef with the help of modern machinery. Just now the analytica method holds the field ; there are several reasons for this—the development of the theory of algebraic integers, the influence of function-theory,.the general " arithmeticising " of analysis ; but a reaction is almost certain to come. It must be remembered that all the available evidence seems to show that Fermat's methods were essentially Diophantine ; and there is very good reason to believe that he was in possession of some peculiar analysis, the secret of which died with him and still awaits rediscovery. Whether this is so or not, there can be no doubt that the cultivation of Diophantine methods deserves more attention than it receives. The risk of failure is great ; but the chance of finding a treasure island exists, and ought to appeal to that spirit of adventure which dwells in every mathematician who is worthy of the name. G. B. M.

MISSIONARY ANTHROPOLOGY.

In Dwarf Land and Cannibal Country. A Record of Travel and Discovery in Central Africa. By A. B. Lloyd. With an introduction by the President of the Church Missionary Society. Pp. xxiv + 385. (London : T. Fisher Unwin, 1899.)

FURTHER information regarding the dwarfs of the north-eastern part of the Congo Basin is one of the main desiderata in African anthropology. We therefore turned to this volume hoping, from its title and size, for detailed measurements of these dwarfs, convincing evidence as to whether they belong to several tribes or are all clans of one tribe, and for further light on their beliefs and folklore. But we are disappointed, for the book adds practically nothing to our knowledge of this group of dwarfs, and the title is misleading. The book narrates the story of Mr. Lloyd's missionary labours and adventures from July 14, 1894, to the end of 1898 ; most of these three and a half years were spent in the Uganda Protectorate, and the author's acquaintance with the Congo dwarfs was obtained between October 6 and 15, 1898. The account of his experiences with this people occur only within some seventeen pages, whereas 368 are devoted to " Out of Dwarf Land."

The bulk of the book is occupied with an account of

Mr. Lloyd's voyage from England to Zanzibar *via* the Cape ; of his journey from Zanzibar to Uganda by the German road ; of his residence in Uganda and of his share in the operations against our unfortunate Soudanese troops, in which he and his colleagues took a prominent part, although, as the author remarks, "the honours and distinctions that were showered upon the military section did not reach the missionaries" ; and finally of his plucky march across the Ituri forests to Ugarrowa (where Stanley first met with his dwarfs in this region), and return home down the Aruwimi and the Congo.

Mr. Lloyd's hurried march gave him few opportunities of studying the dwarfs, so that he adds little to the descriptions of Stanley, Stuhlmann, and Burrows. The only point worthy of notice is that his evidence supports the belief that the pygmies have a fetish worship. It is not clear from Mr. Lloyd's account what clan or tribe of pygmies he met with. How much has been lost by Mr. Lloyd's haste can be gauged from his remarks elsewhere on African customs. He looks on anthropological questions from a typically missionary standpoint. He has a low opinion of the "average African," whose universal laziness he deplores. He describes the aim of the Watoro festivals as "the indulgence in all the evil passions of human nature, fighting and murder, lasciviousness and wanton wickedness. Devil dances of a most disgusting character, witchcraft and fetishism are all practised upon these occasions, and it is at such times that one sees the utter degradation of heathenism." The customs of these Watoro "are most barbarous. For instance, they have an extraordinary practice of breaking off all the front teeth in the lower jaw" ; this is "a thoroughly heathen practice."

Mr. Lloyd's contributions to the natural history of Central Africa are more startling than numerous. On p. 107 he gives us a photograph of a "boa constrictor" killed on Ukerewe, one of the islands in the Victoria Nyanza.

The main value of this book is its unwilling witness to the vast improvement effected in the Congo Basin since the establishment of the Congo Free State, twenty years ago. For instance, Mr. Lloyd was able to cross from the eastern frontier to the Atlantic in only a trifle over two months ; he marched safely through the forests with a party of nineteen men ; he found the cannibals of the Bangwa tribe always friendly, and remarks "that a jollier set of black men I never in all my life had to do with." This testimony as to the revolution of social conditions is the more striking because the author is even more critical of the Congo Free State than he is of the militarism of the Germans and the ritual of the Universities' Mission at Zanzibar.

TELEPHOTOGRAPHY.

Telephotography. By Thomas R. Dallmeyer. Pp. xv + 148. (London : William Heinemann, 1899.)

IN this handsome volume all that is at present known about the theory and practical use of the telephotographic lens is brought together. Mr. Dallmeyer, as our readers may remember, was one of the first who tried to discover an arrangement of lenses which would produce an enlarged image of any distant object on the ground glass of a camera without any excessive length of camera, and the success which rewarded his labours is now well known.

It is interesting to remark that the author's attention was first directed to this subject by Dr. P. H. Emerson, who, as we are told in the preface, urged upon him "the necessity of a photographic instrument to enable the naturalist to record incidents that were then only possible by telescopic observation."

In the year 1892 Mr. Dallmeyer published a small pamphlet containing an interesting collection of papers that had been published relating to his new telescopic photographic lens, and he included in this numerous pictures illustrating the application to the photography of distant objects. This we understand is now out of print. The present volume will therefore be very acceptable to all who use, or intend to use, this form of lens, especially when one is reminded by Mr. Dallmeyer that, with the exception of one or two articles on the practical application of the lens by Mr. Lodge, Mr. Marriage, and Dr. Spitta, the subject has not been handled by any other English writer.

The author, in his treatment of the subject, introduces the reader first to the elementary properties of light ; he then discusses the formation of images by the pin-hole camera, pointing out some valuable hints relative to the rendering of true perspective effects that may be gained from a study of the images obtained with such an instrument. The next two chapters deal with the formation of images by positive and negative lenses, and these serve as an excellent introduction to the following chapters, in which are described the methods of obtaining enlarged images by employing either two positive lens-systems or a combination of a positive and negative system, which constitutes the telephotographic lens.

From the theoretical the author turns to the practical side of the subject, and in the succeeding chapters he describes the use and effects of the diaphragm, practical applications and working data, concluding with a brief bibliography.

Quite a distinct feature of the volume is the fine series of illustrations, which brings out vividly, and more than mere words can describe, the great practical use of this form of lens, not only to the stay-at-home photographer, but to those whose duties lie in various directions. Nearly all the plates illustrate views taken, for the sake of comparison, with both the ordinary lens and the telescopic lens. Among these we find portraits which illustrate the value of this lens for obtaining correct perspective effects in the studio, enlarged pictures of the human eye, eclipse pictures, glaciers photographed at a distance of ten miles, views of an encampment taken from a balloon at a height of 800 metres, a photograph of a grounded man-of-war taken during war time at a distance of two miles, and, lastly, reproductions of Mr. Lodge's excellent studies of birds and their nests. The variety of the illustrations gives one an idea of the numerous useful and valuable applications to which such a lens is specially adapted.

The now great popularity and wide use of the tele-